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THE STUDY APPROACH AND PERCEIVED NEEDS FOR AN ADVANCED THEATER TRANSPORT

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SUMMARY

The Advanced Transport Technology Mission Analysis (ATTMA) is a broad based investigation of future tactical airlift mission requirements and of the attendant technologies necessary to satisfy those requirements. The ATTMA study is a joint Aeronautical Systems Division, Deputy for Development Planning (ASD/XR) and Wright Research and Development Center, Technology Exploitation Directorate (WRDC/TX) initiative. This paper addresses the approach taken in the study effort and the perceived needs for a 21st century Advanced Theater Transport (ATT). The descriptors "theater, tactical, and intratheater" are used synonomously in this paper and are to be differentiated from a "strategic" or "intertheater" airlifter.

Specific military airlift tasks are defined in detail for Europe, Southwest Asia, and Central America that are representative of the kinds of missions that we believe will drive the demand for theater airlift in the 21st century. ~~These tasks then serve as a basis for comparing the productivity/effectiveness~~ of alternative system options. Presented are the results of conceptual STOL and VSTOL airlifters relative to the current US airlift fleet in accomplishing the tasks defined above. Perceived system deficiencies and corresponding needs are identified. One such need is improved cargo handling (loading/unloading and transshipment) for future theater airlifters operating into short, austere landing sites in or near a threat environment. When one considers the many variations in intermodel interfaces with present or future airlifters and the potential increase in the need for theater airlift on an international scale, the cargo handling issue may be one of several that could benefit greatly from international cooperation.

*Airlift operations; *Transport aircraft; Theater level organizations.

INTRODUCTION

The US Army's evolving AirLand Battle doctrine features the concept of a non-linear battlefield where versatile and highly maneuverable fighting units are operating autonomously with largely non-existent or indefensible ground lines of communication. Prosecuting warfare under this concept may demand airlifters that are highly responsive, capable of operating into and out of an austere combat environment quickly. In examining the role of the future theater airlifter in this context, the mission analysis and technology planners at the Aeronautical Systems Division (ASD) embarked on a program of in-house and contracted mission analysis, technology application, and concept development to understand the key issues and to assess their impact on mission requirements and technology needs. The examination of future airlift needs is conducted in the context of three projected notional scenarios: the European Central Region, Southwest Asia, and Central America. The regions represented in these scenarios offer a diverse sampling of geographic features, infrastructure, climatic conditions, and threat intensities necessary for a comprehensive analysis.

With perceived changes in Fig 1 in the ways the US may be fighting future wars, study efforts were focused on the accomplishment of (1) a good understanding of the problem, (2) an analytical basis for establishing needs, (3) the identification of critical technologies, and (4) the identification of key system-level trade-offs.

To gain insights into the problem, let's look at current airlift capabilities shown in Fig 2. If the Continental United States (CONUS) is located on the lower left of this highly simplified chart and the combat arena on the far right, then we see theater airlift operations today and in the near-term, with the airlifters as shown. We can operate into and out of some of the forward operating locations (FOLs) and forward operating bases (FOBs) with runways at least 3000ft (900M) - 4000ft (1200M) long and that are in the Army's Corps rear. But from there, cargo for the Army must be transshipped forward as needed by available trucks, helicopters, etc. The big question here is, "Is this going to be good enough for the 21st century?"

If the Air Force is really serious about supporting the US Army's evolving AirLand Battle doctrine, then Fig 3 depicts the future role of theater airlift via the additional arrows. Here, the future airlifter is called upon to operate forward of the FOBs and FOLs and near and along combat areas. On occasion and under special circumstances, with external support, the airlifter may be required to enter combat areas. Further, as the Army concept of a non-linear battlefield evolves and becomes implemented, each aircraft mission flown in support of Army operations could occur in an active combat area. As a result, US airlifters may be required to fly in harm's way more than they have ever done before. Although not presented in this paper,

considerable work in survivability was done to determine the goals for the needed survivability enhancements.

The theater transport of the future, as will be shown throughout the rest of this paper, may be called on to operate world-wide in a variety of climatic conditions ranging from the plains of Europe to the mountains of Southwest Asia to the jungles of Central America, against varying threats that are far more lethal than in the past. Operations into and out of remote and austere locations with unimproved runways, limited or non-existent landing aids, and in many cases, no material handling equipment will be required routinely.

APPROACH

The study approach in Fig 4 began with a "Needs Analysis." The Foreign Technology Division at Wright-Patterson Air Force Base developed a 20 year threat projection to airlifters in three scenarios, Europe, Southwest Asia, and Central America. The threat was documented and is updated periodically. Next, it was necessary to postulate a finite set of typical airlift tasks or jobs in each of the three scenarios for the 21st century. This was done with the help of Military Airlift Command (MAC) and the US Army and resulted in the identification of approximately seventy-five different cargo movement tasks or jobs that were representative of the nature and spectrum of interservice airlift tasks anticipated. These jobs constituted the "definition of the problem" or the jobs to be done by our airlift fleet. We next defined the baseline force in our airlift fleet as consisting of C-130Hs and C-17s. The deficiency analysis examined how well the C-130Hs and C-17s accomplished the set of jobs in the threat defined in each of the three scenarios. From this, system deficiencies were identified which in turn influenced system needs. Technology opportunities for ATTMA were examined by the Wright Research and Development Center to identify critical technologies that could be applied to system needs.

After the threat, the jobs, the baseline force, the deficiencies, and the technology opportunities were defined, members of the airframe industry (Boeing, Douglas, and Lockheed) were engaged to provide potential solution concepts sensitive to each of the elements in this approach. The solution concepts obtained were then evaluated by the Air Force to determine how well they performed relative to the baseline force in accomplishing the given job set in the presence of the projected threat. The General Research Corporation was an additional contractor engaged by the Air Force to provide specialized modelling and analysis support.

This complete cycle through the study approach has become known as our "First Iteration." Several of the following figures will amplify upon key elements of the study approach.

The representative airlift jobs fall into the five major categories shown in Fig 5; that is deployment, employment, retrograde, reconstitution, and alternate missions. In accord then with the way that a thirty day war builds up in each scenario and the way in which the combat areas were expected to move, specific cargo movements in the operations were defined in terms of the job characteristics shown. In defining and adding credibility to the jobs, operational airlift expertise was a necessity and this is where both MAC and the US Army were very helpful.

Thirty representative ATTMA jobs were defined for the European 30 day conflict. These jobs are highlighted in Fig 6 to illustrate the spectrum of tasks chosen. Although not shown specifically, all jobs are defined by closure time, movement priority, frequency of occurrence, size/weight, threat proximity, distance to delivery, etc. Closure time is the time required to deliver the total tonnage for a particular job. Priority relates to an operational determination of job importance. Frequency is how often the job occurs in a thirty day period. These parameters provide an indication of the detail necessary to define the jobs within a theater of operation.

Fig 7 presents bar charts of the tonnage distribution of the European jobs in Fig 6 by unit moves, emergency resupply, routine resupply, evacuation, and retrograde equipment. The frequency of occurrence of typical airlift activities and how they compare in total tons delivered are shown for a fixed level of tonnage delivered in a 30 day period. It can be seen that unit moves constitute 36% of the tonnage moved, whereas emergency resupply and routine resupply together makeup more than 50% of the tonnage.

It's also important to note that ATTMA is not just working the traditional airbase-to-airbase problem in theater airlift. We are concerned with where the job begins, where it ends, and the transportation modes and the infrastructure in-between. The intent is to minimize the travel time between entry and delivery sites and thereby enhance responsiveness. Fig 8 highlights the various delay points in delivering cargo from entry to delivery sites using a STOL or conventional aircraft. A VSTOL concept minimizes the delays in flying directly from entry to delivery points. One of the goals of this study is to quantify the differences between STOL and VSTOL airlift concepts.

The frequency and order of job occurrences are a direct function of force build-up and combat area movement in each scenario, and represent the cargo type, tonnage, and movement necessary to satisfy the theater airlift demand as a function of time. Fig 9 shows the demand function for Europe derived from the European job set shown earlier,

and also includes similarly derived demand functions for Southwest Asia and Central America from their respective job sets. The functions are broken down into categories to illustrate the types of cargo to be moved. The categories are passengers (PAX), bulk, ammo, fuel, and vehicles. The breakdown offers insight into the nature of airlift requirements per theater. Also presented is the percentage of cargo delivered into and near the combat area. These demand functions are fed into a simulation of a 30 day war in each scenario and serve as a basis for comparing the productivity/effectiveness of alternative systems in a mixed force. It must be remembered that these demand functions are representative of the tonnages required in a portion of each theater and do not constitute total theater airlift tonnage.

CONCEPT DEVELOPMENT

As indicated earlier, study contracts with industry (Boeing, Lockheed, and Douglas) were initiated to obtain a data base describing a range of potential system concepts for a future theater airlifter. The selected configurations from those studies are presented in the matrix shown in Fig 10, by concept type, payload box-size, and contractor. The contractors were asked to look at not only STOL and VSTOL concepts, but also low observable versions of each. They were directed to begin with a C-130H box-size and to examine the range of payload variants from 25,000 lbs (11.36 Metric Tons or MTs) to 60,000 lbs (27.27 MTs). The elements in the matrix are lift-propulsion combinations of the concepts selected. For example, USB TF represents "Upper Surface Blowing - Turbo Fan;" EBF PF represents "Externally Blown Flaps - Prop Fan;" TP stands for "Turbo-Prop;" and the rest are self explanatory. Approximately one-hundred configurations were developed by the contractors and screened down to the 22 shown. A further screening by the Air Force resulted in a detailed in-house analysis of 16 final concepts.

The payload/range performance of the advanced concepts in Fig 10 is presented in Fig 11 for the purpose of comparison relative to the C-130H. The advanced concepts carry only internal fuel while the C-130H in the comparison requires external fuel also. The improved performance over the C-130H is largely a function of technology changes since the 1950s in areas such as materials, propulsion, lift devices, and fuels. The V-22 OSPREY performance envelope is included for additional comparison.

In addition to developing concepts, there is a need to measure their benefits/penalties throughout the development process. To this end, an airlift transportation model was devised for ATTMA and is called the Generalized Air Mobility Model (GAMM). Fig 12 illustrates the features, inputs, and outputs of the model. As a function of the 30 day war scenario, cargo movement requests from the demand functions are processed by the transportation model scheduler. The scheduler considers the available aircraft, cargo priority, and destination, and assigns aircraft to accomplish the delivery. The figures-of-merit illustrated as outputs represent those most commonly used herein, with many other outputs available also. The use of the model is analogous to controlling a taxicab system in one of our major cities where every cab is tracked by tail number and reports into a central command post on a regular basis to pick up new assignments and to report any problems. The survivability parameter for each aircraft configuration being analyzed is determined separately and input into the model. The model is capable of handling mixed fleet operations and was instrumental in producing the system comparisons to be presented next.

For the fixed fleet analysis results presented in Fig 13, the baseline for comparison is a mixed fleet of C-130Hs and C-17s. The fleet consists of 80 C-130Hs and 16 C-17s in both Europe and SWA scenarios, whereas there are 16 C-130Hs and 2 C-17s in the Central American scenario. The alternative concepts are similarly employed in a mixed fleet with C-17s, with a one-for-one substitution of ATTs for C-130Hs. The figure-of-merit in this illustration is percentage improvement in tons delivered-on time relative to the normalized baseline. Three payload/box size variations are examined for each configuration. This analysis holds fleet size constant with productivity and cost being variable. For the European scenario postulated, the STOL configuration is most effective. However, box size does not appear to be a factor. The use of the C-17 in conjunction with the alternative concepts appears to compensate quite nicely for variations in ATT payload/box size. Examination of the effectiveness measure for Southwest Asia and Central America indicates quite a different story. Southwest Asia can be best satisfied by a large STOL or VSTOL because of large distances separating take-off and landing sites, relatively few airfields which are far apart, high hot conditions at many of the landing sites, and long transshipment distances over poor roads. Central America is best satisfied by a medium VSTOL aircraft because of short distances separating take-off and landing sites, an abundance of many very small air strips cut out of the jungle, and very poor roads for transshipment. These findings indicate that Europe may not be the scenario driving requirements for an ATT, and that C-17 allocation and usage are critical to the solution.

Another view of the problem is obtained by comparing the baseline with mixed fleets of alternative STOL concepts in Europe relative to equal effectiveness. Fig 14 demonstrates the equal effectiveness parameter, total tons delivered, for a number of fleet sizes. Fleet size is varied as a ratio of aircraft "X" and C-17 aircraft. Aircraft "X" represents the C-130H or one of the three boxsize/payload variants of the STOL ATT alternative concept. At a fleet size of 80/16, the baseline exhibits an 80% total tons delivered figure-of-merit. For the same fleet size, the alternative concepts

achieve 100% total tons delivered. For equal fleet effectiveness, the alternative concepts achieve the 80% figure-of-merit with less than 1/2 the C-130H fleet size. The small box size concepts achieve 80% effectiveness at a fleet size of slightly greater than 30/6, the medium at approximately 25/5, and the large at slightly greater than 20/4. This analysis indicates that any of the STOL payload/box size alternatives can achieve acceptable effectiveness in the European scenario at greatly reduced fleet sizes relative to the baseline. The issue now becomes one of cost, C-17 utilization rate and availability, and the business strategy embraced by MAC.

NEEDS

The need for a future theater airlifter is based on support requirements of US Army doctrine, increasing obsolescence of our present tactical transport aircraft, a rapid advance in enemy threat capabilities, and the existence of exploitable technological opportunities capable of providing the means to counter current deficiencies. These are expanded upon as follows. (1) The Army's AirLand Battle doctrine and its emerging future operational concepts emphasize securing or retaining the initiative and exercising it aggressively to defeat the enemy. Tactical airlift is pivotal to support of the Army's rear, close-in, and deep operations, as well as Special Operations Force augmentation. Transshipment logistics are prohibitively expensive in this environment and must be minimized. To satisfy these future tactical airlift requirements, an airlifter must be capable of delivering essential cargo directly to the user without traditional airfield/cargo handling constraints. (2) The C-130 has been the primary theater airlifter since 1955. C-130 design did not envision today's emphasis on low-level flying, shortfield delivery requirements, greatly increased threat, etc. A need exists for a future airlifter that is affordable, reliable, supportable, maintainable, dependable, and available in present and future operating environments, especially with a non-linear battlefield. Consequently, unless that capability is acquired, present and future tactical airlift requirements cannot be met. (3) The present and future threat environment is far more lethal than that envisioned by designers of the current defenseless tactical airlifter. Present tactical airlift inadequacies and the increased enemy threat dictate a requirement for incorporating advanced survivability features that minimize threat exposure in the air and on the ground. This present threat environment coupled with enemy air defense advancements and predictions for future proliferation casts doubt on our ability to meet theater airlift demands without an enhanced capability. (4) Application of advanced technological features (i.e., vertical lift/advanced propulsions, low-observables, composite materials, etc.) will provide a quantum leap in capability to satisfy many aspects of the tactical airlift mission. Technological advancements focusing on rapid cargo onload/offload and aerial delivery improvements are of particular importance. Dramatic advances in cargo aircraft payload/field length performance, flight characteristics, aeromedical capabilities, survivability, maintainability, and cargo handling are achievable, and investigations of their applicability must be accelerated.

The needs stated above are general in nature and must be quantified. Through implementation of the ATTMA study approach presented earlier, a summary of the major "perceived needs" taking shape thus far for an advanced airlift system is presented in Figs 15 and 16. One of the key needs is a short field capability that can provide retail delivery into short austere landing sites that have little or no material handling support. Aircraft systems with short field capabilities from near-vertical operations to a 2000ft STOL capability are being examined. A corollary need for operations into austere areas is a landing gear with a soft field capability. Equally important for austere operations is the needed independence from external support for loading/unloading operations. A range of load/unload concepts is being investigated to perform the load/unload operations in minutes rather than hours. Similarly, we need to be able to convert from a cargo configuration to a medical evacuation configuration in minutes instead of hours. And finally, the most important need of all in today's austere defense budget is affordability. We must present the user with alternatives that are highly productive, low risk, and affordable. An aggressive goal to pursue is to maintain the $/ton delivered for the new airlifter equivalent or less than that of the C-130.

There isn't enough space in this paper to discuss all the "perceived needs." Suffice to say, the study is continuing with the intent to quantify as many needs as possible, to determine applicable tradeoffs, and to identify critical technologies.

FUTURE ACTIVITIES

Today's deficiencies in theater airlift productivity have been discussed throughout this paper and Fig 17 summarizes some of the key ones. Our airlifters today are as good as is the infrastructure they are operating in. With long, hard-surface runways, with many airfields, and with a good road structure for transshipment, we can demonstrate a reasonably good transportation capability with theater airlift. In a much poorer infrastructure, where most of our future conflicts may occur, or with a non-linear battlefield, today's system has limitations. Today's capability is also tied to the 463L Material Handling System, an aging and resource limited contingent of loaders and unloaders not very well-suited for operations in forward, austere environments. Today's airlift force is airdrop-capable; however, the airdrop function by its very nature is

excellent for emergency situations but is a very inefficient one for sustained operations and creates a heavy training burden. Airland operations, if possible, are far more preferable.

As shown in Fig 18, today's deficiencies may be greatly reduced by building an airlift system that strives to become independent of the scenario infrastructure; that is, it has a short field capability and a soft-surface landing gear for getting into the short austere fields as close to the customer as possible. Once there, its quick self unload capability permits a rapid departure to escape attrition while on the ground. Because the system provides direct support to the customer, there is a great need for a good command, control, communications, and intelligence (C3I) link.

The thrust then for the future is to continue technology development, continue the development of system concepts and joint concepts of operation with the Army, improve our methodology for comparing alternative systems (improve GAMM to be sensitive to cargo handling constraints and C3I), and encourage opportunities for international cooperation.

Because of the importance of the cargo handling issue, which has been mentioned several times in this paper, it is the subject of an Air Force initiative urging international cooperation. The proposed plan for the study, scheduled to start yet sometime this calendar year, is presented in Fig 19. It begins with a determination of the cargo that must be moved under what conditions, how quickly and to where. Next, a broad range of solution concepts is explored to obtain an initial screening of feasible concepts. Those with the most potential are developed further and assessed again, with the identification of critical technologies needing further development. Independent studies by interested countries will be conducted over a period of 12-18 months with 2-3 joint meetings throughout to exchange data and findings. Details of the study are yet in the early planning stages.

The key elements of our future acquisition activities for the ATT in the near term include 2nd Iteration studies, Concept Direction studies, and Demonstration/Validation. We are currently in the early portion of our 2nd Iteration studies investigating both STOL and VSTOL concepts. Concept Direction studies will focus onto a single concept while Demonstration/Validation could pave the way for an advanced airlifter by approximately 2005 at the earliest. Concurrent with these activities are various ongoing working groups, individual study efforts, and technology initiatives throughout government and industry, all under the advanced airlift umbrella.

CLOSING REMARKS

As evidenced by the results reported in this paper, there is much US interest in an advanced theater airlifter. To date, we've defined the problem, established the key needs, identified the key tradeoffs, and have begun to analyze them. The STOL aircraft represents the low risk approach. The propeller VSTOL in a variety of forms looks promising in many respects, but much work yet remains. With the austere defense budgets predicted for the future, there is a great need for encouraging international cooperation. The cargo handling initiative may be the beginning of what could lead to an international aircraft development effort that could have broad implications for both military and commercial transports of the future.

- WITH PERCEIVED CHANGES IN
  - DOCTRINE
  - THREAT
  - MISSION

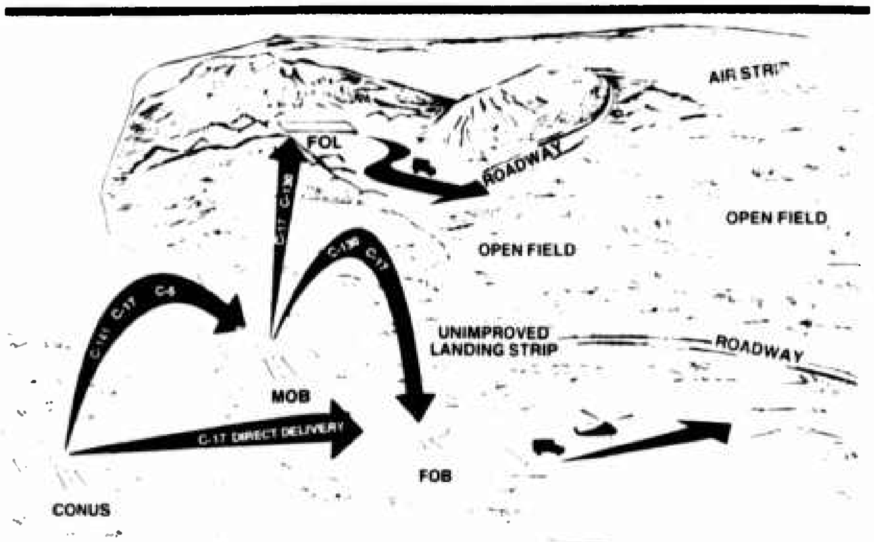
  NATURE OF WARFARE

- ARE TECHNOLOGY PLANS SUFFICIENT TO SUPPORT 21ST CENTURY SYSTEM DEVELOPMENTS FOR INTRATHEATER AIRLIFT?

- WHAT ARE THE KEY SYSTEM-LEVEL TRADEOFFS?

FIG 1
WHY AN ADVANCED THEATER TRANSPORT

FIG 2
CURRENT AIRLIFT OPERATIONS



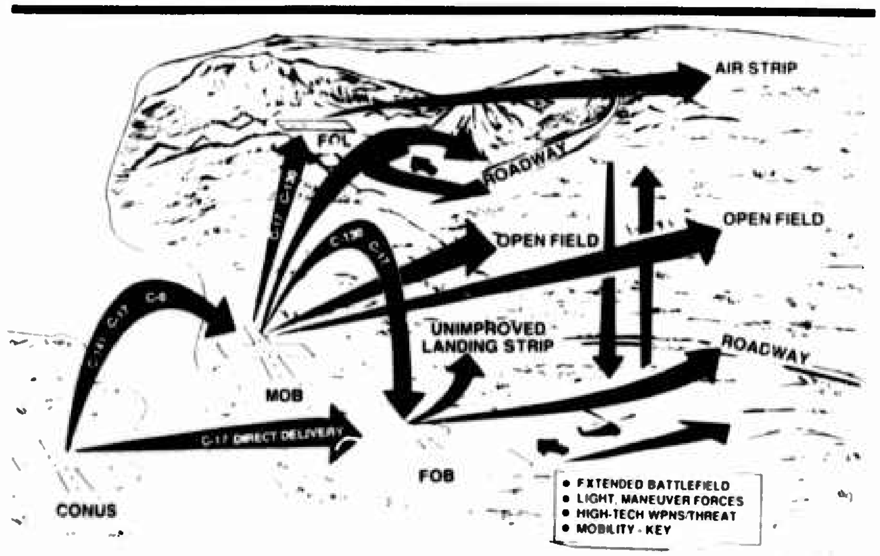


FIG 3
FUTURE AIRLIFT OPERATIONS

- NEEDS ANALYSIS
  - THREAT
  - INTRATHEATER JOBS
  - C-130/C-17 BASELINE
  - DEFICIENCY ANALYSIS
- TECHNOLOGY OPPORTUNITIES
- SYSTEM CONCEPTS
- EVALUATION

FIG 4
APPROACH

- BY THEATER
  - EUROPE - SOUTHWEST ASIA - CENTRAL AMERICA
- BY CATEGORIES
  - DEPLOYMENT
  - RETROGRADE
  - RECONSTITUTION
  - EMPLOYMENT
  - ALTERNATE MISSIONS
- BY SPECIFIC CHARACTERISTICS
  - SPECIFIC CARGO
  - FREQUENCY
  - THREAT
  - TONNAGE
  - ENTRY/DELIVERY
  - PRIORITY

FIG 5
JOB
DEFINITIONS

UNIT MOVE [36]

- MLRS BN (2)
- A-X SQDN (5)
- HAWK BATTERY (4)
- ATF SQDN (6)
- AIRLIFT SQDN (1)
- BDE MOVE (2)
- MOBILE HOSPITAL (1)
- AIR AMBULANCE CO (1)
- POMCUS/UNIT MARRIAGE (5)
- BN TASK FORCE (1)
- DEEP ATTACK (1)

ROUTINE RESUPPLY [20]

- USAF BASE (10)
- AMMO/POL (6)
- ADMINISTRATIVE (29)
- RATIONS (8)
- PERSONNEL REPLACEMENT (12)

EVACUATION [8]

- BERLIN (8)
- MEDICAL (20)
- KIAS (30)
- REFUGEES (8)

EMERGENCY RESUPPLY [31]

- CRITICAL EQP'T (10)
- CHEM GEAR (68)
- AMMO (5)
- BN (14)
- PGM/POL (34)
- SPEC WPNS (4)
- UNIT RELOCATION (5)
- EQUIPMENT MOVE (50)

RETROGRADE [5]

- EQUIPMENT (28)
- A-X SQDN (1)

[ ] % TOTAL WT AIRLIFTED
( ) JOB FREQUENCY

FIG 6
REPRESENTATIVE
JOBS–EUROPE

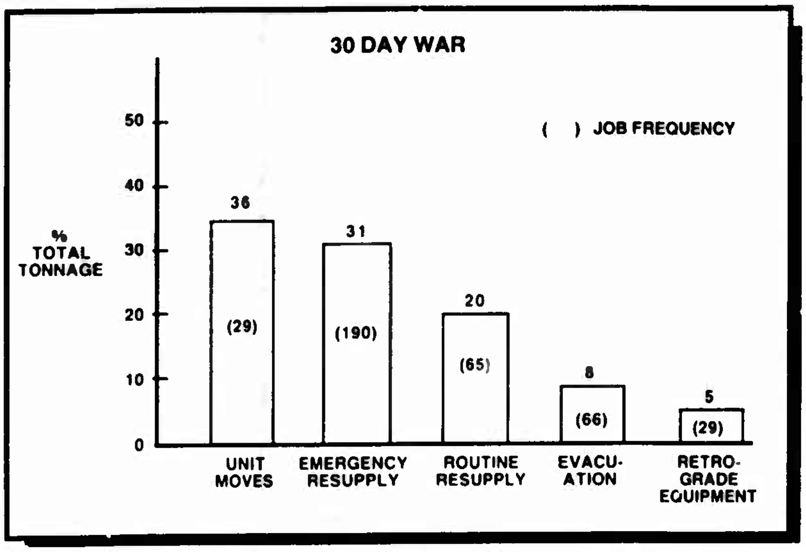
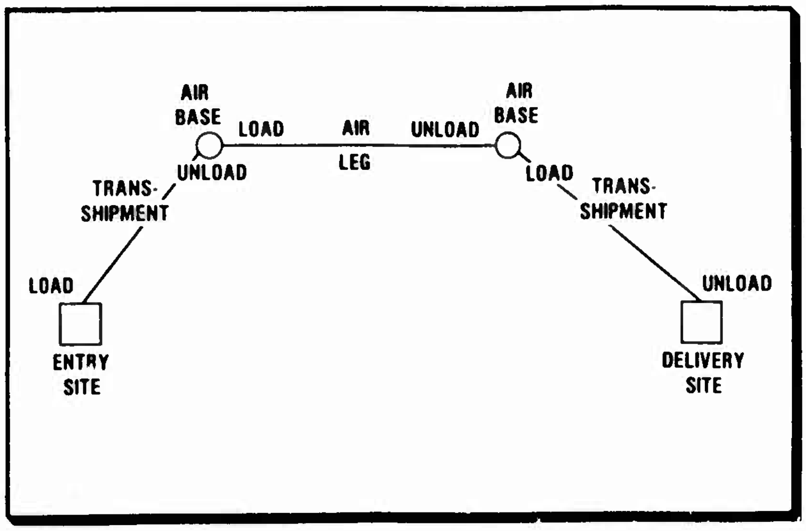
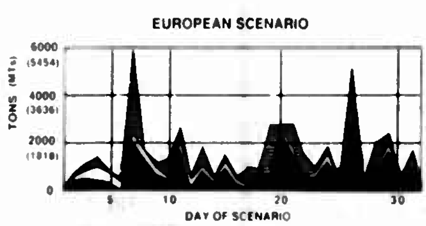


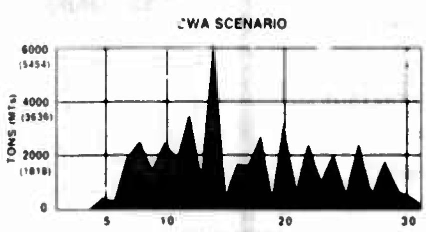
FIG 7
REPRESENTATIVE
TONNAGE
EUROPE

FIG 8
ENTRY-TO-
DELIVERY





TONNAGE DEMAND 30 DAYS			
	EUROPE	SWA	CA
TONS (MTs)	49706 (45187)	41181 (37437)	10438 (9489)
PAX %	23	18	22
BULK FUEL % AMMO	13 12 (44) 19	5 8 (31) 18	16 24 (48) 8
VEHICLES + OUTSIZE	33	51	30
ACROSS FLOT %	4.5	3.0	48
NEAR FLOT	5.0	5.5	11



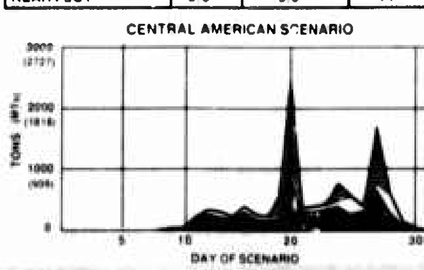
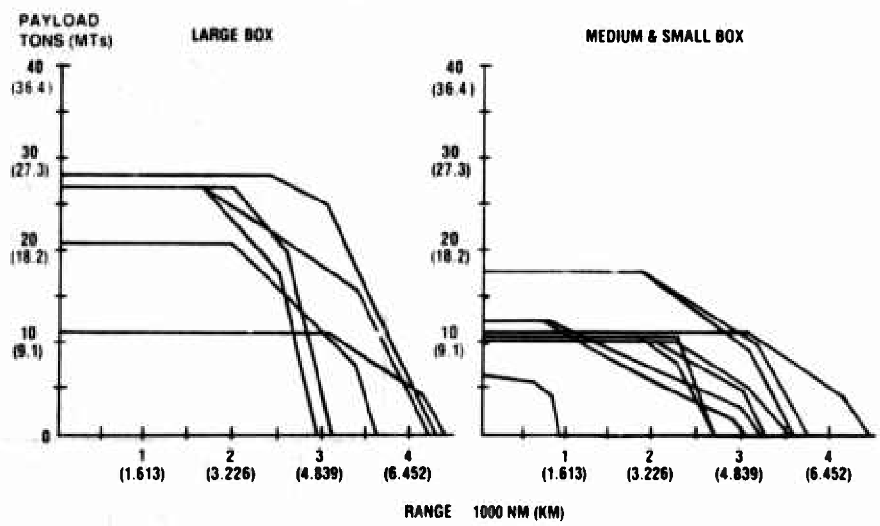


FIG 9
REPRESENTATIVE
DEMAND
FUNCTIONS

CONCEPT TYPE	BOX SIZE: SMALL	MEDIUM (C-130H SIZE)	LARGE	CONTRACTOR
STOL	USB TF EBF TF EBF PF	EBF TF EBF PF	EBF PF USB TF EBF TF EBF PF	BOEING DOUGLAS LOCKHEED
LO STOL	EBF TF	LIFT FAN + CRUISE	EBF TF	B D L
VSTOL	TILT WING TP	LIFT + CRUISE TILT PROP	LIFT + LIFT CRUISE	B D L
LO VSTOL	LIFT + CRUISE LIFT + LIFT CRUISE	LIFT + CRUISE	LIFT + CRUISE LIFT FAN + CRUISE LIFT + LIFT CRUISE	B D L

FIG 10
ATTMA
CONCEPT
MATRIX

FIG 11
PAYLOAD
RANGE



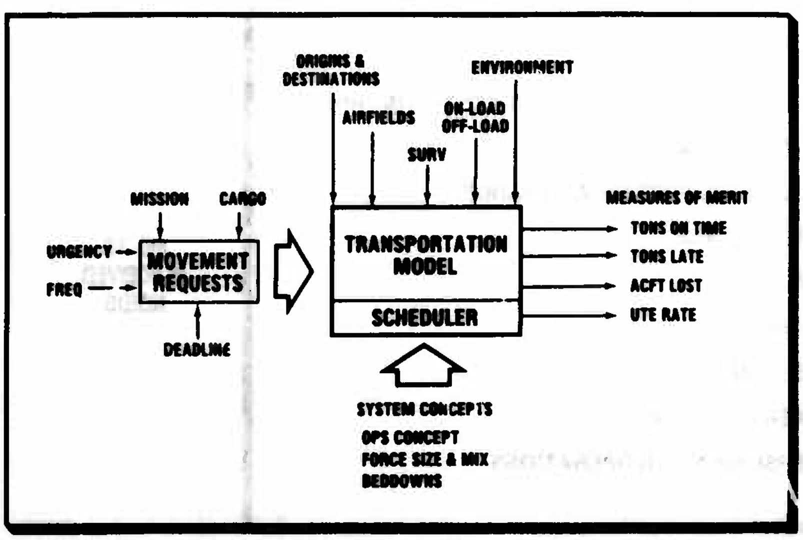


FIG 12
GENERALIZED
AIR MOBILITY
MODEL (GAMM)

EQUAL FLEET SIZE — 30 DAY WAR

CONFIGURATION	SIZE	EUROPE	SW ASIA	CA
BASELINE	MED	1.0	1.0	1.0
C STOL	LARGE	1.4	1.6	2.1
	MED	1.4	1.4	2.1
	SMALL	1.4	1.3	1.5
LO STOL	LARGE	1.3	1.4	1.8
	MED	1.3	1.4	2.0
	SMALL	1.3	1.2	1.4
C VSTOL	LARGE	1.2	1.6	2.0
	MED	1.3	1.5	2.3
	SMALL	1.2	1.3	1.4
LO VSTOL	LARGE	1.2	1.5	1.7
	MED	1.3	1.3	2.3
	SMALL	1.2	1.5	1.4

FIG 13
NORMALIZED
FLEET
EFFECTIVENESS

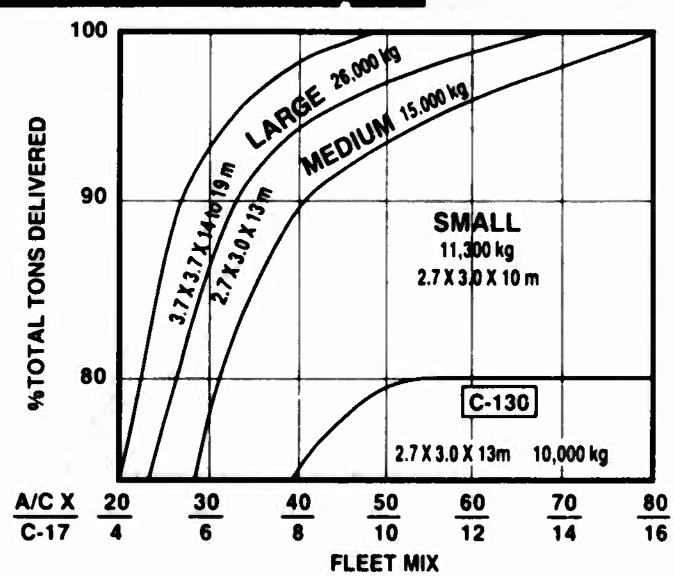


FIG 14
STOL
PRODUCTIVITY
EUROPE

- SHORT FIELD CAPABILITY
- MAX PAYLOAD-MULTI-LAUNCH ROCKET SYSTEM (MLRS)
- SOFT FIELD/TAKEOFF AND LANDING
- TERRAIN FOLLOWING/TERRAIN AVOIDANCE
- LANDING WITHOUT AIDS
- 3-MAN CREW
- SELF LOAD/UNLOAD
- STATION KEEPING
- IMPROVED AERIAL EXTRACTION
- NIGHT/ADVERSE WEATHER OPERATIONS

FIG 15
PERCEIVED
NEEDS

- REAL-TIME MISSION PLANNING
- HIGH SURVIVABILITY-IN AIR/ON GROUND
- RELIABILITY/MAINTAINABILITY
- REPAIRABILITY
- COMPATIBILITY WITH OTHER AIRLIFTERS
- LOW SPOT FACTOR/GOOD GROUND MOBILITY
- CONVERTIBILITY TO MEDICAL EVACUATION
- HIGH UTILITY FOR ALTERNATE MISSIONS
- AFFORDABILITY
- AERIAL REFUELING

FIG 16
PERCEIVED
NEEDS (CONT)

- INFRASTRUCTURE DEPENDENT
  - LONG, HARD-SURFACE LANDING SITES
  - NUMBER & DENSITY OF LANDING SITES
  - ROADS, TERRAIN, ETC
- TIED TO 463L SYSTEM
  - RESOURCE LIMITED
  - AGING
  - LONG DELAYS
- AIRDROP
  - INEFFICIENT
  - HEAVY TRAINING BURDEN
- NOT SURVIVABLE
- LIMITED C^3I
- HIGH OPERATING & SUPPORT COSTS

FIG 17
AIRLIFTER
PRODUCTIVITY
TODAY

- TODAY'S DEFICIENCIES MAY BE GREATLY REDUCED WITH
  - SHORT FIELD CAPABILITY
  - SOFT SURFACE LANDING GEAR
  - SELF LOAD/UNLOAD
  - SURVIVABILITY-ON GROUND & IN AIR
  - C^3I TIE WITH USER AND MISSION PLANNING
- FUTURE THRUST
  - JOINT ACTIVITIES (HQ MAC & ARMY)
  - CONTINUED TECHNOLOGY DEVELOPMENT
  - CONCEPT DEVELOPMENT
  - CONCEPT OF OPS DEVELOPMENT
  - IMPROVEMENT OF TOOLS (MODELS)
  - INTERNATIONAL COOPERATION

FIG 18
AIRLIFTER
PRODUCTIVITY
TOMORROW

- DETERMINE MISSION NEEDS
  - CARGO
  - ENVIRONMENT
  - MODE INTERFACES
  - LOAD/UNLOAD TIMES
  - THREAT
  - REPRESENTATIVE MISSIONS
- EXPLORE BROAD RANGE OF SOLUTION CONCEPTS
  - NOTIONAL/INNOVATIVE
  - SCREENING METH'Y
  - IDENTIFY HIGH PAYOFF CONCEPTS
  - TECHNOLOGY AUDIT TRAIL
- DEVELOP/EVALUATE HIGH PAYOFF CONCEPTS
  - FIRST ORDER DESIGNS TO ASSESS FEASIBILITY
  - METHODOLOGY AND COMPARISON OF ALTERNATIVES
  - IDENTIFY CRITICAL TECHNOLOGIES
- RECOMMEND FUTURE FOLLOW-ON ACTIVITY

FIG 19
CARGO HANDLING
STUDY